

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**

CLAIMS

What is claimed is:

1 1. A fiber optic module comprising:
2 a pull-actuator to disengage and withdraw the fiber optic
3 module from a cage assembly; and
4 one or more electro-optic transducers to convert optical
5 signals into electrical signals or electrical signals into
6 optical signals.

1 2. The fiber optic module of claim 1 wherein
2 the fiber optic module is a small form pluggable (SFP)
3 fiber optic module and the cage assembly is a small form
4 pluggable (SFP) cage assembly.

1 3. The fiber optic module of claim 1 wherein
2 the pull-actuator is activated to disengage and withdraw
3 the fiber optic module by a single backward pull action.

1 4. The fiber optic module of claim 1 wherein
2 the pull-actuator includes one or more grooves to
3 slideably engage the fiber optic module.

1 5. The fiber optic module of claim 1 wherein
2 the fiber optic module includes one or more grooves to
3 slideably engage the pull-actuator.

1 6. The fiber optic module of claim 1 wherein
2 the pull-actuator slides to disengage the fiber optic
3 module from the cage assembly.

1 7. The fiber optic module of claim 1 wherein
 2 the pull-actuator includes,
 3 one or more end-stops to withdraw the fiber optic
 4 module as the pull-actuator is pulled.

1 8. The fiber optic module of claim 1 wherein
 2 the pull-actuator includes
 3 one or more end-stops to prevent the pull-actuator
 4 from becoming disengaged from the fiber optic module as it is
 5 pulled.

1 9. The fiber optic module of claim 1 wherein
 2 the pull-actuator includes
 3 a pull-tab,
 4 a shaft coupled to the pull tab at a first end, and
 5 an opening at a second end of the shaft to engage a
 6 first end of a pivot arm.

1 10. The fiber optic module of claim 1 wherein the pull-
 2 actuator includes
 3 an orientation indicator to indicate the fiber optic
 4 module which the pull-actuator releases.

1 11. The fiber optic module of claim 1 wherein
 2 the pull-actuator is formed of metal.

1 12. The fiber optic module of claim 1 wherein
 2 the pull-actuator is formed of a plastic.

1 13. The fiber optic module of claim 1 further
 2 comprising:

3 a pivot-arm actuator, pivotally coupled to the fiber
4 optic module, to release the fiber optic module from the cage
5 assembly when the pull-actuator is pulled.

1 14. The fiber optic module of claim 13 wherein
2 the pivot-arm actuator further includes,
3 a pivoting pin to rotationally couple the pivot-arm
4 actuator to the fiber optic module.

1 15. The fiber optic module of claim 13 wherein the
2 pivot-arm actuator includes
3 a first engaging end to engage to the cage assembly,
4 a second engaging end to engage to the pull-
5 actuator, and
6 a shaft coupling to the first and second engaging
7 ends.

1 16. The fiber optic module of claim 15 wherein
2 the first engaging end includes a keeper to engage the
3 fiber optic module to the cage assembly.

1 17. The fiber optic module of claim 15 wherein
2 the first engaging end includes a latch to engage the
3 fiber optic module to the cage assembly.

1 18. The fiber optic module of claim 15 wherein
2 the second engaging end includes a keeper to engage the
3 pivot-arm actuator to the pull-actuator.

1 19. The fiber optic module of claim 15 wherein
2 the second engaging end includes a latch to engage the
3 pivot-arm actuator to the pull-actuator.

1 20. The fiber optic module of claim 15 wherein
2 the second engaging end includes a ramped sliding surface
3 to slide and cause the pivot-arm actuator to rotate when the
4 pull-actuator is pulled.

1 21. The fiber optic module of claim 13 further
2 comprising:
3 a spring to cause the pivot-arm actuator to return to its
4 initial position when the pulling force on the pull-actuator
5 is removed.

1 22. The fiber optic module of claim 21 wherein
2 the spring is a leaf spring and part of the pivot-arm
3 actuator.

1 23. The fiber optic module of claim 21 wherein
2 the spring causes the pull-actuator to return to its
3 initial position when the pulling force on the pull-actuator
4 is removed.

1 24. The fiber optic module of claim 1 wherein the pull-
2 actuator permits arranging multiple fiber optic modules in a
3 belly-to-belly configuration without obstructing adjacent
4 pull-actuators.

1 25. The fiber optic module of claim 24 wherein with the
2 belly-to-belly configuration, two pull-actuators are located
3 in proximity to each other along a common surface between two
4 fiber optic modules.

1 26. A pull-actuator for fiber optic modules, the pull-

2 actuator comprising:

3 a pull-tab;

4 a pull-arm coupled to the pull-tab at a first end; and

5 a catch at another end of the pull-arm to latch to a

6 second actuator.

1 27. The pull-actuator of claim 26 wherein

2 the pull-actuator slides to cause the second actuator to

3 disengage a fiber optic module from a cage assembly.

1 28. The pull-actuator of claim 26 wherein pulling the

2 pull-actuator causes the second actuator to release a fiber

3 optic module from a cage assembly.

1 29. The pull-actuator of claim 26 wherein

2 the pull-actuator includes one or more grooves to

3 slideably engage a fiber optic module.

1 30. The pull-actuator of claim 26 wherein

2 the pull-actuator includes

3 one or more end-stops to withdraw a fiber optic

4 module as the pull-actuator is pulled.

1 31. The pull-actuator of claim 26 wherein

2 the pull-actuator includes

3 one or more end-stops to prevent the pull-actuator

4 from becoming disengaged from a fiber optic module as it is

5 pulled.

1 32. The pull-actuator of claim 26 wherein the pull-tab

2 includes an orientation indicator to indicate a fiber optic

3 module which the pull-actuator releases.

1 33. The pull-actuator of claim 26 wherein the second
2 actuator is a pivot-arm actuator which pivots to disengage a
3 fiber optic module from a cage assembly when the pull-actuator
4 is pulled.

1 34. The pull-actuator of claim 26 wherein the pull-
2 actuator permits arranging multiple fiber optic modules in a
3 belly-to-belly configuration without obstructing adjacent
4 pull-actuators.

1 35. The pull-actuator of claim 34 wherein with the
2 belly-to-belly configuration, two pull-actuators are located
3 in proximity to each other along a common surface between two
4 fiber optic modules.

1 36. A pivot-arm actuator for fiber optic modules having
2 one or more electro-optic transducers, the pivot-arm actuator
3 comprising:

4 a pivot arm which causes a fiber optic module to be
5 released from a cage assembly when a pull-actuator is pulled;
6 and

7 a pivoting pin to rotationally couple the pivot arm to a
8 fiber optic module.

1 37. The pivot-arm actuator of claim 36 wherein the pivot
2 arm includes,

3 a first engaging end with a keeper to engage a fiber
4 optic module to a cage assembly.

1 38. The pivot-arm actuator of claim 36 wherein the pivot
2 arm includes,

3 a first engaging end with a latch to engage a fiber optic
4 module to a cage assembly.

1 39. The pivot-arm actuator of claim 36 wherein the pivot
2 arm includes,
3 a second engaging end, opposite the first engaging end,
4 with a keeper to engage the pivot-arm actuator to a pull-
5 actuator.

1 40. The pivot-arm actuator of claim 36 wherein the pivot
2 arm includes,
3 a second engaging end, opposite the first engaging end,
4 with a latch to engage the pivot-arm actuator to a pull-
5 actuator.

1 41. A pull de-latch mechanism for fiber optic modules,
2 the pull de-latch mechanism comprising:
3 a pull-actuator; and
4 a pivot-arm actuator coupled to the pull-actuator at a
5 first end, wherein pulling the pull-actuator causes the pivot-
6 arm actuator to rotate thereby releasing a fiber optic module
7 from a cage assembly.

1 42. The pull de-latch mechanism of claim 41 wherein the
2 pivot-arm actuator includes
3 a ramped sliding surface at the first end which causes
4 the pivot-arm actuator to rotate when the pull-actuator is
5 pulled thereby releasing a fiber optic module from a cage
6 assembly.

1 43. The pull de-latch mechanism of claim 41 wherein the
2 pivot-arm actuator includes
3 a keeper at a second end, opposite the first end, to

4 couple the fiber optic module to a cage assembly.

1 44. The pull de-latch mechanism of claim 41 wherein
2 the pull-actuator includes
3 an orientation indicator to indicate the fiber optic
4 module which the pull-actuator releases.

1 45. The pull de-latch mechanism of claim 41 wherein,
2 the pull-actuator includes grooves to slideably engage a
3 fiber optic module.

1 46. The pull de-latch mechanism of claim 41 wherein
2 the pull-actuator includes
3 one or more end-stops to withdraw the fiber optic
4 module as the pull-actuator is pulled.

1 47. The pull de-latch mechanism of claim 41 wherein
2 the pull-actuator includes
3 one or more end-stops to prevent the pull-actuator
4 from becoming disengaged from the fiber optic module as it is
5 pulled.

1 48. The pull de-latch mechanism of claim 41 wherein the
2 pull de-latch mechanism permits arranging multiple fiber optic
3 modules in a belly-to-belly configuration without obstructing
4 adjacent pull de-latch mechanism.

1 49. The pull de-latch mechanism of claim 48 wherein the
2 belly-to-belly configuration two pull-actuators are located in
3 proximity to each other along a common surface between two
4 fiber optic modules.

1 50. A fiber optic module comprising:
 2 means for converting optical signals into electrical
 3 signals or electrical signals into optical signals; and
 4 means for disengaging the fiber optic module from a cage
 5 assembly by pulling a pull-actuator.

1 51. The fiber optic module of claim 50 further
 2 comprising:
 3 means for slideably engaging the means for disengaging
 4 the fiber optic module.

1 52. The fiber optic module of claim 50 wherein the means
 2 for disengaging also provides a means for withdrawing.

1 53. The fiber optic module of claim 50 further
 2 comprising:
 3 means for withdrawing the fiber optic module.

1 54. The fiber optic module of claim 50 further
 2 comprising:
 3 means for pivotally disengaging the fiber optic module
 4 from a cage assembly when the pull-actuator is pulled.

1 55. The fiber optic module of claim 54 further
 2 comprising:
 3 means for coupling the pivotally disengaging means to the
 4 fiber optic module.

1 56. The fiber optic module of claim 50 further
 2 comprising:
 3 means for indicating the fiber optic module which the

4 means for disengaging releases.

1 57. A method for disengaging and withdrawing a fiber
2 optic module from a cage assembly comprising:
3 pulling a pull-actuator to disengage the fiber optic
4 module from the cage assembly; and
5 continuing to pull on the pull-actuator to withdraw the
6 fiber optic module from the cage assembly.

1 58. The method of claim 57 comprising:
2 releasing the pull-actuator if the fiber optic module has
3 been released from the cage assembly.

1 59. A fiber optic module comprising:
2 a nose receptacle including
3 a fiber optic cable receptacle to receive one or
4 more fiber optic cable plugs,
5 a pull-actuator to release the fiber optic module
6 from a cage assembly using a pull action;
7 a pivot-arm actuator coupled to the pull-actuator,
8 the pivot-arm actuator to pivot and release a keeper from a
9 latch to release the fiber optic module in response to a pull
10 action on the pull-actuator; and
11 a printed circuit board including one or more
12 electro-optic transducers to convert optical signals into
13 electrical signals or electrical signals into optical signals.

1 60. The fiber optic module of claim 59 wherein,
2 the fiber optic module is a small form pluggable (SFP)
3 fiber optic module and the cage assembly is a small form
4 pluggable (SFP) cage assembly.

1 61. The fiber optic module of claim 59 further

2 comprising:

3 a housing to couple to the nose receptacle and cover the
4 printed circuit board.

1 62. The fiber optic module of claim 61 wherein,
2 the housing is shielded to protect the printed circuit
3 board from electromagnetic interference.

1 63. The fiber optic module of claim 59 wherein,
2 the pull-actuator includes one or more grooves to
3 slideably engage the nose receptacle.

1 64. The fiber optic module of claim 59 wherein,
2 the pull-actuator slides outward to release the fiber
3 optic module from the cage assembly.

1 65. The fiber optic module of claim 59 wherein,
2 the pivot-arm-actuator includes
3 a pivot pin rotationally coupled to the nose receptacle
4 at first and second ends to allow the pivot-arm actuator to
5 pivot.

1 66. The fiber optic module of claim 59 wherein
2 the nose receptacle further includes
3 a spring coupled to the pivot-arm-actuator at a first end
4 and the nose receptacle at a second end, the spring to exert a
5 force on the pivot-arm-actuator to exert a return force on the
6 pull-actuator.

1 67. The fiber optic module of claim 59 wherein,
2 the pull-actuator includes
3 an orientation indicator to indicate the fiber optic

4 module which the pull-actuator releases.

1 68. The fiber optic module of claim 59 wherein,
2 the pull-actuator includes
3 a pull-tab,
4 a shaft coupled to the pull-tab at a first end, and
5 a catch at a second end of the shaft.

1 69. The fiber optic module of claim 59 wherein,
2 the pull-actuator is located at a bottom side of the
3 fiber optic module.

1 70. The fiber optic module of claim 59 wherein,
2 the nose receptacle further includes
3 a grip to pull out on the fiber optic module.

1 71. A configuration of fiber optic modules having one or
2 more electro-optic transducers, the configuration comprising:
3 a printed circuit board having a first side and a second
4 side;
5 a first cage coupled to the first side of the printed
6 circuit board to receive a first fiber optic module; and
7 a second cage coupled to the second side of the printed
8 circuit board to receive a second fiber optic module, the
9 second cage aligned in parallel to the first cage such that a
10 first belly of the first fiber optic module is adjacent a
11 second belly of the second fiber optic module.

1 72. The configuration of claim 71 wherein,
2 the first belly of the first fiber optic module being
3 adjacent to the second belly of the second fiber optic module
4 provides for increased density.

1 73. The configuration of claim 71, further comprising:
2 the first fiber optic module having a first pull-actuator
3 with a first orientation indicator;
4 the second fiber optic module having a second pull-
5 actuator with a second orientation indicator; and
6 the first pull-actuator and the second pull-actuator each
7 having a pull-tab offset from each other when the first belly
8 is adjacent the second belly.

1 74. The configuration of claim 73 wherein,
2 the first orientation indicator indicates the first fiber
3 optic module and the second orientation indicator indicates
4 the second fiber optic module.

1 75. The configuration of claim 73 wherein,
2 the pull-tab is a pull button.

1 76. The configuration of claim 73 wherein,
2 the pull-tab is a pull knob.

1 77. The configuration of claim 73 wherein,
2 the pull-tab is a pull hook.

1 78. The configuration of claim 73 wherein,
2 the pull-tab is a pull ring.

1 79. The configuration of claim 73 wherein,
2 the pull-tab is a pull square.

1 80. The configuration of claim 73 wherein,
2 the pull-tab is a pull mechanism.